

## *Title*

Discovery of Supply Voltage Variation Effect on Material Heat Release Results

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## *Abstract*

Material heat release testing is required for certification (receiving inspection, process control, engineering testing) of all large composite panels installed in commercial passenger airplane interiors. Instruments at Boeing Seattle, Everett, and Charleston locations run daily, producing the data needed to support compliance showings to 14 CFR 25.853(d) for post-crash fire safety. Composite test coupons representing panel constructions are subjected to a pilot ignition flame and heat is radiated onto the coupon surface to produce combustion heat release profiles. Radiant heat flux is kept within specified limits using manual power dials that typically require adjustment only when operating on evenings and weekends when supply power levels are elevated due to decreased system loading.

Boeing Flammability lab personnel observed daily and weekly patterns in heat flux density variation. Review of the test specification and instrument design indicated no content to address supply voltage variation. A joint BCA, BR&T, and Fabrication division team was assembled to investigate the premise that changes in supply voltage were driving the heat flux density variations.

Supply voltage at the Boeing Everett Lab was monitored and significant variation was evident. Intra-day variations of 3 volts were recorded, with intra-week ranges in excess of 6 volts. Initial findings were shared with FAA and industry at the International Materials Fire Test Forum (IMFTF), an international body tasked with improving aircraft fire safety testing methods and reducing test method variability.

Experiments were designed and conducted at the Boeing Everett Lab over a period of several months. Relatively small variations in supply voltage were shown cause heat flux to be out of the specified tolerance range. These heat flux changes were then shown to have a statistically significant effect on material heat release results. All findings were shared with the FAA and industry at International Materials Fire Test Forum (IMFTF) meetings, prompting focused dialogue on the need to control supply voltage and reduce test result variability.

The Boeing team worked jointly with a leading instrument manufacturer to develop, test, and improve an active voltage conditioning solution. A second generation system was installed on the Boeing Everett instrument for evaluation.

This work is defining the industry standard approach to controlling supply voltage variation in current and future materials test instruments. It is a key driver of FAA specifications, and will lead to quantifiable improvements in test result accuracy and repeatability across industry.